

1 WHAT IS CLAIMED:

2

3 1. A method for retaining a treatment chemical in a subterranean
4 formation containing hydrocarbons, the method comprising:

5

6 (a) preparing an emulsion including:

7

8 (i) an oil continuous phase;

9

10 (ii) a first aqueous phase including a first treatment chemical
11 which is to be retained in a subterranean formation; and

12

13 (iii) a second aqueous phase including a second chemical
14 which is to be reacted with the first treatment chemical in
15 the subterranean formation to enhance retention of the
16 treatment chemical in the subterranean formation;

17

18 wherein the first and second aqueous phases remain generally
19 separately dispersed and stable within the oil continuous phase;

20

21 (b) placing the emulsion down a well bore and into the subterranean
22 formation; and

23

24 (c) allowing the first and second aqueous phases to interact with
25 one another in the subterranean formation such that the first
26 treatment chemical and the second chemical react with one
27 another resulting in the first treatment chemical securing to the
28 subterranean formation.

29

30 2. The method of claim 1 wherein:

31

32 the oil continuous phase includes at least one surfactant which aids in
33 the formation of the oil continuous emulsion.

- 1 3. The method of claim 2 wherein:
2
3 the surfactant includes one of an anionic surfactant and a non-ionic
4 surfactant.
5
- 6 4. The method of claim 1 wherein:
7
8 the oil continuous phase and the first and second aqueous phases
9 separate or invert within the subterranean formation to enhance the
10 rate of reaction between the first and second aqueous phases.
11
- 12 5. The method of claim 4 wherein:
13
14 the subterranean formation contains fluids including hydrocarbons and
15 water and the water in the subterranean formation assists in the
16 inversion of the emulsion from an oil continuous phase to a water
17 continuous phase.
18
- 19 6. The method of claim 4 wherein:
20
21 the emulsion receives heat from the subterranean formation which
22 enhances the inversion of the emulsion from an oil continuous phase to
23 a water continuous phase.
24
- 25 7. The method of claim 4 wherein:
26
27 the inversion of the emulsion from an oil continuous phase to a water
28 continuous phase is enhanced by the presence of salt in the
29 subterranean formation which increases the salinity or ionic strength
30 of the aqueous phase.

- 1 8. The method of claim 4 wherein:
2
3 the step of inverting the oil continuous phase and the first and second
4 aqueous phases is enhanced by an inclusion of a delayed release
5 agent in the emulsion which will alter the pH of the emulsion as the
6 emulsion warms.
7
- 8 9. The method of claim 8 wherein:
9
10 the delayed release agent is sulfamic acid.
11
- 12 10. The method of claim 1 wherein:
13
14 the first aqueous phase and the second aqueous phase are prepared
15 as separate oil continuous emulsions prior to their being mixed
16 together to form the oil continuous emulsion which is placed down the
17 well bore and into the subterranean formation.
18
- 19 11. The method of claim 1 wherein:
20
21 the first treatment chemical includes at least one of a scale inhibitor, a
22 proppant, a polymer and a conformance controller.
23
- 24 12. The method of claim 1 wherein:
25
26 the first treatment chemical includes a scale inhibitor and the amount of
27 active scale inhibitor is in the range of 0.5-35 % wt./vol. of the first
28 aqueous phase.
29
- 30 13. The method of claim 12 wherein:
31
32 the amount of active scale inhibitor is in the range of 5-15% wt./vol. of
33 the first aqueous phase.

- 1 14. The method of claim 13 wherein:
2
3 the amount of active scale inhibitor is in the range of 5-10% wt./vol. of
4 the first aqueous phase.
5
- 6 15. The method of claim 1 wherein:
7
8 the first treatment chemical comprises a scale inhibitor which includes
9 at least one of Nitrilo tri(methylene phosphonic) acid
10 Bis-hexamethylene triamine-penta(methylene phosphonic) acid,
11 Poly(acrylic) acid, Diethylene triamine-penta(methylene phosphonic)
12 acid, Phosphinopolycarboxylic acid, Sulfonated polyacrylic acid,
13 1-Hydroxyethylidene-1,1-diphosphonic acid, and Hexamethylene
14 diamine-tetra(methylene phosphonic) acid.
15
- 16 16. The method of claim 1 wherein:
17
18 the first treatment chemical comprises a scale inhibitor including a
19 combination of at least two of Nitrilo tri(methylene phosphonic) acid,
20 Bis-hexamethylene triamine-penta(methylene phosphonic) acid,
21 Poly(acrylic) acid, Diethylene triamine-penta(methylene phosphonic)
22 acid, Phosphinopolycarboxylic acid, Sulfonated polyacrylic acid,
23 1-Hydroxyethylidene-1,1-diphosphonic acid, and Hexamethylene
24 diamine-tetra(methylene phosphonic) acid.
25
- 26 17. The method of claim 1 wherein:
27
28 the first aqueous phase includes a solvent.
29
- 30 18. The method of claim 1 wherein:
31
32 the second aqueous phase includes a solvent.

- 1 19. The method of claim 1 wherein:
2
3 the retention enhancing agent includes at least one ion of Group II
4 metals, Group III metals, and transition elements in an amount
5 sufficient to react with the first treatment chemical.
6
- 7 20. The method of claim 1 wherein:
8
9 the retention enhancing agent comprises one of metal hydroxide, metal
10 oxide, metal alkoxide and mixtures thereof, and wherein the metal is
11 selected from the group comprising lithium, sodium, potassium,
12 magnesium, calcium, strontium, barium, boron or mixtures thereof.
13
- 14 21. The method of claim 1 wherein:
15
16 the molar ratio of the retention enhancing agent to the first treatment
17 chemical is in the range of 0.5-20:1.
18
- 19 22. The method of claim 21 wherein:
20
21 the molar ratio of the retention enhancing agent to the first treatment
22 chemical is in the range of 0.5-10:1.
23
- 24 23. The method of claim 22 wherein:
25
26 the molar ratio of the retention enhancing agent to the first treatment
27 chemical is in the range of 0.5-5:1.
28
- 29 24. A method for retaining a treatment chemical in a subterranean
30 formation, the method comprising:
31
32 (a) preparing an emulsion including:

- 1 (i) an oil continuous phase including includes at least one
2 surfactant, capable of forming an oil continuous phase
3 emulsion;
4
5 (ii) a first aqueous phase including a first treatment chemical
6 which is to be retained in a subterranean formation; and
7
8 (iii) a second aqueous phase including a second chemical
9 which is to be reacted with the first chemical in the
10 subterranean formation to enhance the retention of the
11 first treatment chemical to the subterranean formation;
12
13 (b) placing the emulsion down a well bore and into the subterranean
14 formation; and
15
16 (c) permitting the first and second chemicals in the aqueous phases
17 to react for a sufficient period of time causing the first treatment
18 chemical to be retained in the subterranean formation.